of Philadelphia. They estimate it traveled from 12,000 to 15,000 miles and required more than five years in its journey.

The *Lusitania* was torpedoed off the Irish coast on May 7, 1915. Hydrographers figure that the belt went through the Irish Sea and around the north of Scotland; down through the North Sea and the English Channel; down the coast of France and Spain and Africa. There the current bore it across the Atlantic. Entering the Gulf Stream, it was carried north. It escaped from this current and drifted to the Delaware capes. Probably the propeller of a steamship caught it up at the capes and brought it up the Delaware. When found afloat it was 100 miles up the river from the capes.

The life belt was covered with barnacles. When these were scraped off the name of the *Lusitania* was found and easily deciphered.

—*H. L.*

THE METEOROLOGY OF THE ANTARCTIC.

551.55 (048) (99)

By G. C. SIMPSON.

[Excerpted from a review of Vols. I–II of the *British Antarctic Expedition, 1910–1913*, published in *Nature*, (London), Dec. 23, 1920, pp. 526–528.]

It was a fortunate day for meteorology when Capt. Scott invited Dr. Simpson to join his last expedition as meteorologist. The Antarctic has always provided a fascinating field on account of the symmetry of its general circulation combined with remarkable local phenomena; but never before has a meteorologist and physicist of the first rank studied Antarctic meteorology on the spot and presented to the world the digested results of observations planned and executed by himself.

* * * The main discussion is divided into nine chapters dealing with temperature, wind, cloud, and precipitation, pressure and its relation to winds and weather, general circulation, the upper air, the height of the Barrier and the plateau, and atmospheric electricity. Each chapter contains not merely a discussion of the results of the observations and a rational explanation of the facts revealed, but also some new contribution (such as, for example, a study of the gustiness of the wind) which was rendered possible only by the new instruments and methods not previously available in Antarctic work.

The annual and diurnal variations of temperature are shown to be, on the whole, due to insolation, but two features present difficulty. There is a diurnal variation of temperature during the months when the sun is completely below the horizon, and the "day" hours are, on the whole, warmer than the "night" hours. No rational explanation is given of this effect. The suggestion that it arises from scattered radiation from the upper layers of the atmosphere which come into the sunshine during the "day" hours is not mentioned, and it appears to be excluded by the fact that the effect is more marked on cloudy than on clear days, and by the further fact that on clear days there are two maxima at about 4 a. m. and 4 p. m., the time of minimum pressure in the semi-diurnal barometer oscillation. The unusual feature in the annual variation is roughly this: On the Barrier the amplitude of the variation is "oceanic" and the phase "continental," while in the Arctic the amplitude is "continental" and the phase "oceanic." The explanation put forward is, roughly, that the continents of Asia and America control the amplitude in the Arctic Ocean, and the Antarctic Ocean controls the amplitude on the Barrier; the argument is well stated, but it is not entirely convincing.

The records from the Dines pressure-tube anemometer, many of which are reproduced, add greatly to the interest of the chapter on wind, and, indeed, to that on temperature, too, by the light they throw on blizzards and other sudden changes. The winds at Cape Evans were found to be about 50 per cent more gusty than the winds at Scilly and Holyhead; but the gustiness decreased as the speed of the wind increased, indicating, according to Dr. Simpson, that the high value was due, not to the exposure, but to the interaction between a warm upper current and a cold surface layer which are coexistent in the Antarctic more frequently than in England.

Pressure waves traveling outwards from the center of the continent are Dr. Simpson's contribution to the explanation of the synoptic charts of the Antarctic. He rejects Lockyer's scheme of traveling cyclones, and pours scorn on the suggestion that the motion of the air in a blizzard is part of a very large cyclonic system. "A depression with its center in 60° S. able to produce a blizzard of 40–60 miles per hour in 78° S. is of course quite inconceivable. Whatever blizzards may be due to, they are certainly not part of the circulation around a cyclone the center of which is more than 1,000 miles away." He appears here to be doing less than justice to Lockyer's scheme, which may represent the broad features of the pressure distribution, even although all the cyclones do not adhere rigidly to the sixtieth parallel of latitude.

The theory of pressure-waves will undoubtedly provoke much discussion; facts are marshalled in an imposing array to support it, and theoretical synoptic charts are produced which are wonderfully similar to the charts based upon actual observations. The pressure waves are apparently not sound waves; they are described as "true pressure waves traversing the upper atmosphere in the same way that water waves travel across the sea"—i. e., they are waves formed at a surface of discontinuity. As the waves appear to be at least 500 miles from crest to trough, there can not be very many of them—probably, in fact, not more than one—in existence at a time, so that the comparison ought to be with one long wave in shallow water (e. g., a tidal wave) rather than with "water waves traveling across the sea"; it appears doubtful if it is possible at the surfaces of discontinuity, which certainly exist in the Antarctic, to get waves 500 miles long traveling at 40 miles per hour, and having pressure amplitudes of 20 millibars at sea level. The horizontal transference of a large mass of air naturally suggests itself as an alternative explanation, but the adjustment of the motion to the pressure gradient presents difficulties.

In his discussion of the general circulation Dr. Simpson arrives at conclusions agreeing in some respects with Hobbs, and in others with Meinardus. Broadly speaking, he makes the whole continent an anticyclonic area surrounded by a broad band of low pressure about latitude 65; but at 10,000 feet the plateau alone is anticyclonic, while a very marked cyclone is centered over the part of the Antarctic which is near sea level. The upper winds deduced from cloud observations and from Erebus's smoke fit in well with the scheme.

The free atmosphere over the Antarctic had never been explored before Dr. Simpson sent up his *ballons-sondes;* the results of this first attempt are remarkably good, although the stratosphere was not reached. Out of 21 ascents, 14 instruments were recovered, of which 12 furnished good records; but three of them referred to different times on one day, November 19, 1911. In six cases of summer ascents the temperature decreased steadily upwards at a rate of about 6° C. per kilometer; in four cases of winter ascents temperature rose at the commencement of the ascent, and began to fall only after a height of one or two kilometers had been reached The lowest temperatures recorded in these ascents was −46° C. (−51° F.) at a height of 6,750 m. (22,000 feet)

on Christmas Day, 1911. The lowest temperature recorded on the Barrier was −60° C. (−76° F.) on July 6, and this is the lowest temperature recorded anywhere in the Antarctic.

METEOROLOGICAL STATION IN GREENLAND.

In *Nature* for May 26, 1921, it is stated that the Danish Government is to make provision at an early date for the establishment in Greenland of a high-powered radio and meteorological station. This action is in accordance with a recommendation of the International Commission for Weather Telegraphy which met in London last November. Such a station will be of untold value to weather forecasting in Europe and possibly in Canada and the United States also. At present the gap between American and European meteorological observations is so great that American observations can hardly be used for European forecasting; but the establishment of the Greenland station will serve as a bridge to this gap and enable European meteorologists to make definite and systematic use of American weather observations.—*C. L. M.*

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